# INSTRUCTIONS FOR OPERATION

# COMMERCIAL POOL HEATERS

## Copper-Fin II® Models 400,000 - 750,000 Btu/hr Input

This section contains specific requirements for Pool Heaters. All warnings, cautions, notes, installation and operating instructions and maintenance requirements from the general Installation and Service Manual apply to these units in addition to the following specific requirements for pool heating equipment. These instructions must be followed closely to obtain maximum life and usage of your pool heater.

### PERFORMANCE

Your pool heater is a high efficiency unit which has been designed to operate scale-free and trouble free for many years. Particular attention should be directed to the following items:

1. Correct adjustment of the pool heater's pumped bypass and valves.
2. Required minimum inlet temperature to pool heater.
3. Correct piping to the pool filter system with specified pipe materials and size.
4. Electrical interconnection of the pool heater controls, bypass pump and filter pump to ensure continuous circulation.

### LOCATION AND VENTING

Consult the Installation and Service Manual for the specific model you are installing. The Installation and Service Manual is included with the basic installation package shipped with the pool heater. This manual contains the specific requirements for clearances from combustible surfaces, combustion and ventilation air requirements, venting requirements, available venting options and gas supply requirements.

**WARNING:** ⚠

LP (propane) gas is heavier than air and will remain at floor level if there is a leak. Basements, crawl spaces, alcoves, and areas below ground level will serve as pockets for accumulation of leaking gas. Before lighting, sniff at floor level. **IF YOU SMELL GAS**, **follow instructions on page 1 of users information manual.** Shut off gas at LP tank outside of building.

**DO NOT OPERATE APPLIANCE UNTIL LEAKAGE IS CORRECTED.**

LP gas cylinders shall be located outdoors and away from the pool structure in accordance with the latest edition of the Standard for the Storage and Handling of Liquified Petroleum Gases, ANSI/NFPA 58, and applicable local codes.

This heater must be installed at least 5 feet from the inside wall of a pool unless separated from the pool by a solid fence, wall or other permanent solid barrier.

**WARNING:** ⚠

A pool heater installed in, under or directly attached to the pool or spa structure must have a manual main gas shutoff valve located outside the pool structure.

When a pool heater is installed within the pool structure, the structure shall be designed such that in the event of a fuel gas leak, the leaking gas is vented to the exterior of the pool structure.

To minimize the possibility of serious personal injury, fire, damage to your pool heater or improper operation, never violate the following safety rules:

1. Always keep the area around your pool heater free of combustible materials, gasoline, pool chemicals and other flammable liquids and vapors.
2. Never cover your unit, lean anything against it, store trash or debris near it, stand on it, or in any way block the flow of fresh air to your pool heater.

**CAUTION:** ⚠

Under no circumstances should the equipment room ever be under a negative pressure. Particular care should be taken when exhaust fans, compressors, air handling units, etc. may rob air from the heater. The combustion air supply must be completely free of any chemical fumes which may be corrosive to the heater. Common chemicals which must be avoided are fluorocarbons and other halogenated compounds, most commonly present as refrigerants or solvents, such as freon, trichlorethylene, perchlorethylene, chlorine, etc. **Combustion air must be free of dust and fumes from chemicals used for pool/spa water treatment.** These chemicals, when burned, form acids which quickly attack the copper tubes, headers, flue collector, and heater stack. The result is improper combustion and premature heater failure.

### ELECTRICAL REQUIREMENTS

The appliance is wired for 120 volt service. The heater when installed, must be electrically grounded in accordance with the requirements of the authority having jurisdiction or in the absence of such requirements, with the latest edition of the National Electrical Codes ANSI/NFPA No. 70.

**Basic Electrical Wiring**

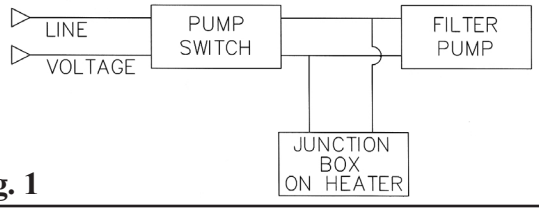


**Fig. 1**

Electrical power circuits to the pool heater must be installed with a ground fault circuit interrupter. Follow local codes for installation of this device.

1. All wiring between the unit and field installed devices shall be made of type T wire [63ºF (35ºC) rise].
2. Line voltage wire exterior to the appliance must be enclosed in approved conduit or approved metal-clad cable.
3. The pump must run continuously when heater is "ON".
4. Do not install any switch which can disconnect pump without disconnecting heater.
5. Check heater controls and pump voltage.
6. Do not energize heater or pump until system is full of water. Serious damage may result.
7. All wiring must be in accordance with all local, state, or federal codes.
8. Provide circulating pump with proper overload protection.
9. Where magnetic starter is used for pump, wire auxiliary contacts in starter in "series" with heater control circuit.

## PLACING THE POOL HEATER IN OPERATION

***PRE-START CHECK LIST***

Before attempting to start the pool heater verify that the following items have been checked:

1. Verify proper location and installation of the pool heater.
2. Check gas piping and ensure line is purged of all air.
3. Ensure that the pool is properly filled. Do not operate pool heater if improperly filled.
4. Check to ensure that all water connections are tight.
5. Relief valve has been piped to a suitable floor drain.
6. Combustion air openings are not obstructed in any way.

## STARTING THE FILTER SYSTEM

1. Verify proper installation of the pool heater temperature controls and the installation of the 110˚F auxiliary limit in the mixed discharge water from the filter piping to the pool.
2. Clean the filter.
3. Start the filter pump. Be sure all air is out of all lines including pressure connection. Ensure that the pool heater is not "air bound" by manually opening the temperature and pressure relief valve. Leave the valve open until a steady flow of water is observed at the discharge from the valve. Close the valve and complete filling the system.
4. Ensure that a manual bypass valve is installed in the filter system and installed between the pipe connection supplying water to the pool heater and the return from the pool heater to the filter system. Adjustment of this valve will divert a portion of the water flow from the filter system to the pool heater for heating.

**NOTE:** Backwash the filter when the GPM filtration rates are too low to meet local codes or state code. A high temperature rise across the pool heater is also an indication of low flow in the filter system. Sustained low flow to the pool heater will result in cycling of the heater on the limit controls and possible opening of the relief valve.

**WARNING:**

**Should overheating occur or the gas supply fail to shut off, turn off the manual gas control valve to the appliance.**

## CONTROL SETTINGS

See the specific requirements of each model for instructions to adjust the temperature set point for the pool heater's operating controls and adjust the heater bypass. Ensure that the limit controls are properly installed.

## LIGHTING AND SHUTDOWN PROCEDURE

Follow the Lighting Instructions section in the Installation and Service Manual for detailed instructions to start the ignition system, turn off gas to the appliance and checkout the ignition system.

## POOL HEATER PIPING INSTALLATION

**Pool Heater Piping to Pool Filter System**

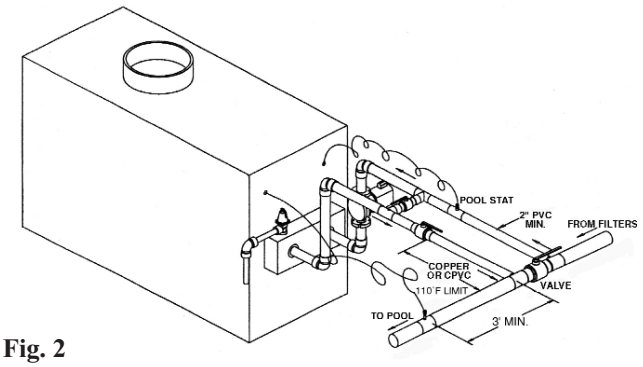


**Fig. 2**

Install piping from the filter system to the pool heater as shown in the pool heater piping diagram. Minimum pipe diameter to and from the installed pool heater to the filter system piping is 2 ft. A valve should be installed in the filter system piping between the supply and return piping connections for the pool heater. This valve can be partially closed to divert a portion of the filter system flow to the pool heater so it can be heated, added to the filter system piping and returned to the pool. The piping from the filter system to the pool heater may be PVC, CPVC or Copper Pipe. **The piping from the pool heater back to the filter system will carry water with temperatures in excess of 110˚F and MUST be CPVC or Copper Pipe.** The temperature of the heated water from the pool heater will be substantially cooled as it is mixed back into the pool water from the filter system and returned to the pool. The mix of heated water and pool water from the filtration system should only be slightly warmer than the pool water before the connections from the pool heater.

## AUXILIARY MIXED WATER LIMIT CONTROL

**Mixed Water Auxiliary Limit Control**

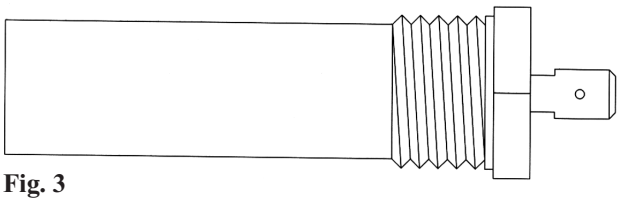

**Fig. 3**

**High Limit Tag**

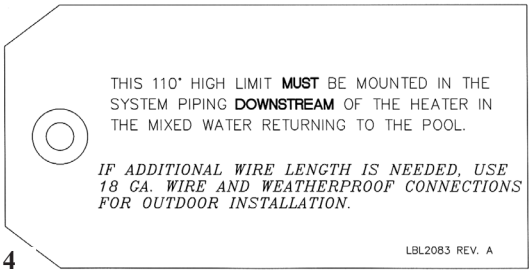
THIS 110° HIGH LIMIT MUST BE MOUNTED IN THE SYSTEM PIPING DOWNSTREAM OF THE HEATER IN THE MIXED WATER RETURNING TO THE POOL.
IF ADDITIONAL WIRE LENGTH IS NEEDED, USE 18 GA. WIRE AND WEATHERPROOF CONNECTIONS FOR OUTDOOR INSTALLATION.
LBL2083 REV. A

**Fig. 4**

Ensure that the auxiliary 110˚F mixed water limit control supplied with the pool heater is installed in the filter system piping a minimum of three feet downstream from the point where the heated water from the pool heater is added to the filtration system piping. The limit may be mounted in a 3/8" NPT tapped fitting installed in the filtration system piping or it may be installed directly into a tapped opening in the PVC filter system piping. Turn off the filter system pump when installing the auxiliary limit in the filtration system piping. A tapped opening can be added to the PVC pipe by first drilling a 9/16" pilot hole in the PVC pipe at least three feet down stream of the point where the heated water from the pool heater is added to the filter piping. The drilled pilot hole can now be carefully threaded with a 3/8" NPT taper tap. After the pipe threads have been cut into the PVC pipe wall, the limit can be inserted into the tapped opening. Apply a small amount of a high quality RTV silicone sealant to the threads on the limit to prevent leaks and install the limit into the threaded opening in the pipe. Install the limit control and tighten to seal. **Do not** over tighten the brass limit into the threaded opening in the PVC pipe. Over tightening the limit can damage the limit and/or strip the threads cut into the plastic pipe. Wire the limit into the pool heater control circuit as shown in the wiring diagram for your model. If additional wire length is needed, use 18 GA wire for distances up to 30 ft. For longer distances, size the wire per the following chart. Use weatherproof connections for outdoor installation.

| Wire Gauge | Maximum Allowable Length |
|---|---|
| 12 GA | 100 ft. |
| 14 GA | 75 ft. |
| 16 GA | 50 ft. |
| 18 GA | 30 ft. |

This pool heater is a high efficiency unit which requires a special pumped bypass on the heater for proper operation. This bypass assembly and the required pump are pre-installed on the heater as shipped from the factory. All piping to connect to the filter system to the pool heater is made directly to the bypass piping on the pool heater. The pump supplied on the pool heater bypass has a sealed motor suitable for outdoor installations. All electrical wiring to the pump must comply with local code requirements.

**Installed Bypass Assembly - Side View**

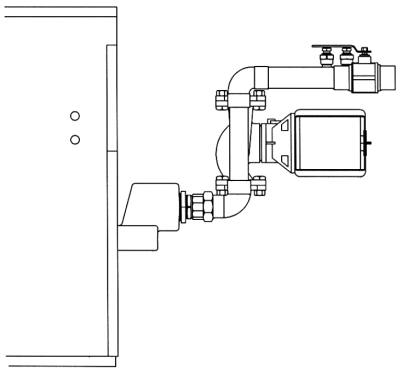

**Fig. 5**

**Bypass Installed on Models CP0401 thru CP0751.**

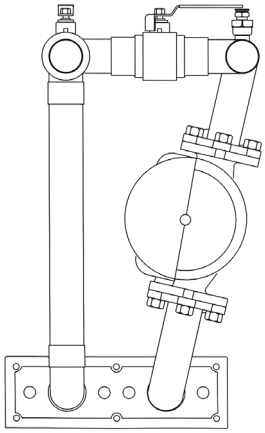

**Fig. 6**

**Bypass Assembly Components - Exploded View**

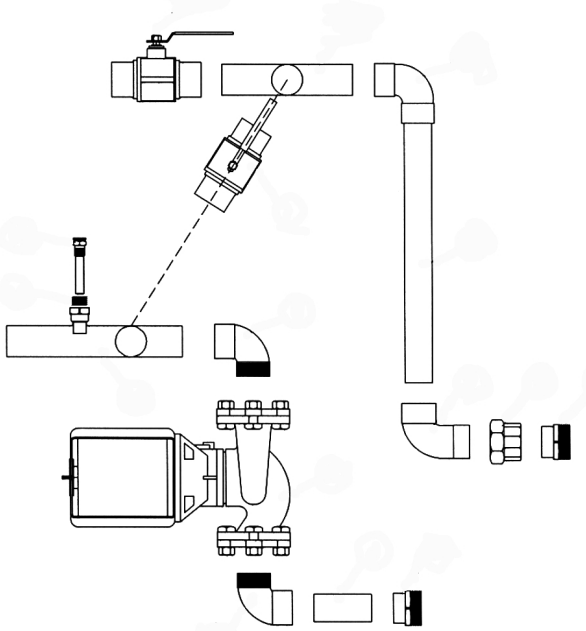

**Fig. 8**

## ELECTRICAL INSTALLATION OF THE CIRCULATOR PUMP MOTOR:

1. The circulator pump must run simultaneously with the filtration system pump. This will prevent damage to the heat exchanger when the filtration pump is out of service.

2. The circulator pump may be wired for 120, 208 or 240 volt electrical service.

**CAUTION ⚠**

**THE HEATER MUST BE INSTALLED ON A 120 VOLT CIRCUIT OR DAMAGE TO THE HEATER CONTROLS WILL OCCUR!**

3. 120 volt supply: Wires 1, 3, & 8 connect to the hot. Wires 2, 4, & 5 connect to the neutral. 208 or 240 volt supply: Wires 2, 3, & 8 Wire nut together. Wire 1 connect to L1. (Hot). Wires 4 & 5 connect to L2 (Hot). **Note**: To reverse rotation switch wires 5 & 8 respectively.

4. Ensure that grounding and bonding conform to applicable electrical codes.

## POOL HEATER MODELS: CP401, CP501, CP651, CP751

## INSTALLATION OF TEMPERATURE CONTROLS AND BYPASS LOOP ADJUSTMENT

NOTE: Following these instructions will permit the system circulating loop to operate at the desired temperature regardless of the higher pool heater water temperatures.

**Location of Temperature Sensors in Pool Heater Piping for Models CP401, CP501, CP651, CP751,**

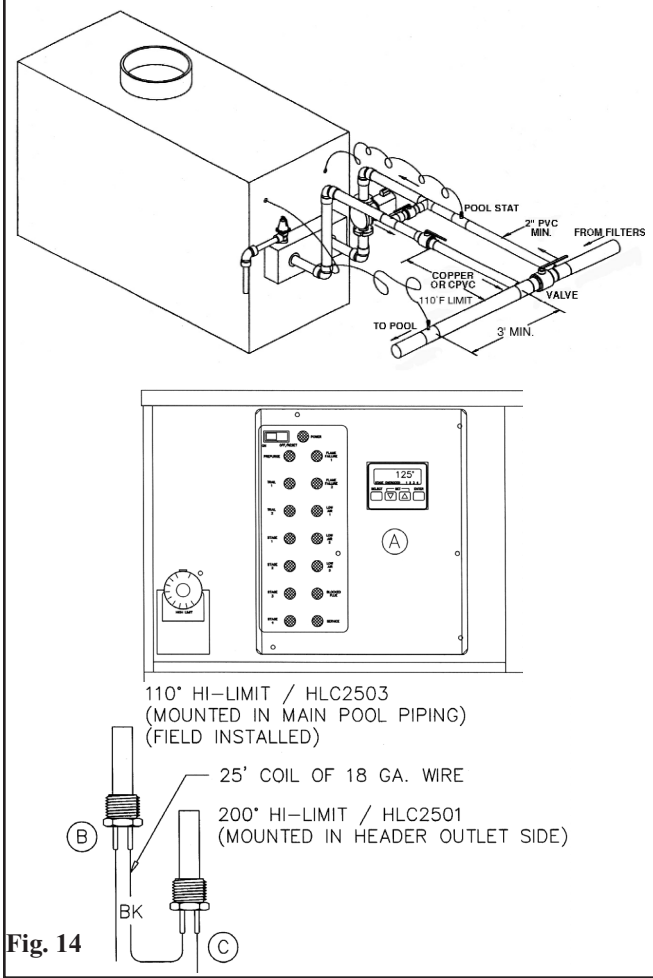


**Fig. 14**

**Inner Control Panel for Models CP 401 thru CP 751**

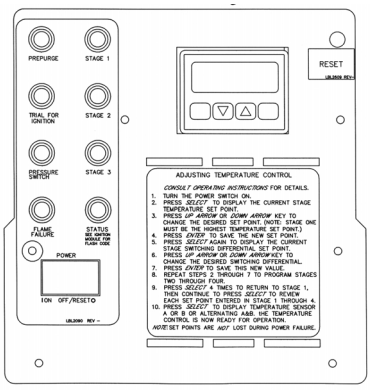


**Fig. 15**

## INSTALLATION OF THE SENSING BULBS FOR TEMPERATURE CONTROL:

1. Models CP401 - CP751 use the units internal electronic digital temperature control as the pool aquastat. The digital temperature control must be programmed to the desired temperature set point for the pool water. The digital temperature control is pre-set from the factory for a pool temperature of 85˚ F. If the set point for the desired pool temperature is to be changed from the factory setting, all stages of the digital temperature control **MUST** be programmed to the same set point. Staged burner operation is achieved by the setting of the differentials in the digital temperature control. Models CP401 and CP501 have a two stage digital temperature control, Models CP651- CP751 have a three stage digital temperature control.

   The differentials for each stage are factory pre-programmed at the following settings; stage 1-2˚F, stage 2-3˚F, stage 3-5˚F (if equipped) and stage 4-7˚F (if equipped). **DO NOT CHANGE THE PRE-SET DIFFERENTIAL SETTINGS.** Wide differences in the set points or differential on the multiple stages will result in sweat and condensate formation on the units copper heat exchanger. This can result in operational problems and a Non-Warrantable failure of the pool heater. A different temperature set point for the desired pool water temperature may be reprogrammed into the digital temperature control. See the detailed instructions in the attached Installation and Operation Instructions to program the digital temperature control. Water temperatures are indicated by the **Sensor A or B** indication in the digital display. **Sensor A**, which is the operating sensor for the digital temperature control, is mounted in the bulb well located in the inlet piping of the bypass assembly. **Sensor A** displays the pool water temperature. **Sensor B** is mounted in the inlet side of the units front header. **Sensor B** serves as a digital thermometer to monitor the temperature of the pre-heated inlet water to the heat exchanger. The pool heater also has 2 fixed setting limit controls, a high limit and an auxiliary limit. The high limit control is factory mounted in the outlet side of the front header.

The auxiliary pool limit must be field installed in the pool filtration return piping system. Connection of the electronic pool aquastat temperature sensor and the limit controls to the 24 VAC control circuit is by wire. No capillary tubes are used for the connection to the sensing bulbs.

2. The temperature sensor (Sensor A) for the electronic digital temperature control for pool water temperature is factory installed in a bulb well located in the inlet piping of the bypass assembly.
3. The temperature sensor for the fixed setting auxiliary limit control must be field installed directly into the heated pool water, downstream of the bypass assembly, in the pool filtration system piping. The limit is pre-wired with 20 ft. of wire. If the field installed location for the auxiliary limit is more than 20 ft. away from the pool heater, simply replace the wires with a longer wire of the proper gauge. If additional wire length is needed when extending the factory wiring to the auxiliary limit, use 18 GA wire for distances up to 30 ft. For longer distances, size the wire per the chart in the Auxiliary Mixed Water Limit Control Section. Use weatherproof connections for outdoor installation. The auxiliary limit must be a minimum of 3 ft. from the point where the heater bypass piping plumbs into the pool filtration return piping. This ensures that the limit will sense a proper mixed water temperature. Placing the auxiliary limit to close to the heater piping connections can result in nuisance tripping of the auxiliary limit. The sensor for the auxiliary limit control is identified with a tag labeled: "110˚F High Limit."

**Pool Controls Wiring Diagram for Models CP401, CP501, CP651 & CP751**

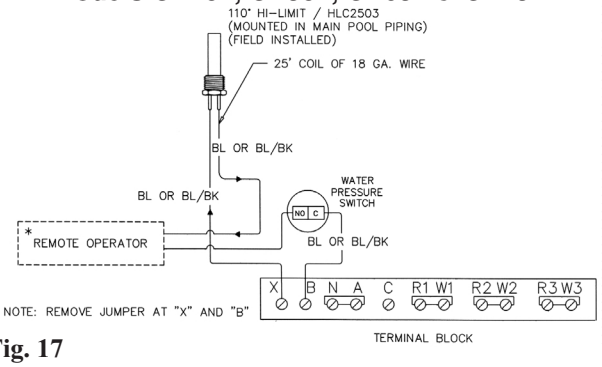


**Fig. 17**

***PRE-START CHECK LIST*:**

1. Clean the filter before attempting to adjust the water flow.
2. The reading from **Sensor B** on the digital temperature control corresponds with the temperature of the water entering the pool heater. **Sensor A** reads the pool water temperature.
3. The bypass pump must run continuously when the filter system is operating.
4. With the pump operating and the pool heater turned off, both the inlet and outlet temperatures should equalize.

## ADJUSTMENT OF THE AUXILIARY CONTROLS AND THE SET POINT OF THE ELECTRONIC POOL HEATER CONTROLS:

1. Start the adjustment with the heaters bypass discharge valve half closed and the bypass valve full open.
2.* The pool heater's internal adjustable high limit should be preset at 200˚F as a redundant high limit control.
3. The pool heater also has a 200˚F fixed setting high limit installed in the discharge side of the units front header.
4. The field installed auxiliary limit control has a fixed setting of 110˚F to limit the maximum discharge water temperature to the system.
5. The units electronic digital temperature control serves as the pool heater aquastat and should be should be set at the desired pool temperature setting (usually 80˚F to 85˚F), not exceeding the maximum temperature allowed by applicable codes. Carefully read the Installation and Operation Instructions supplied with the unit if it is necessary to change the factory pre-set pool temperature of 85˚F.
6. Start the heater and observe the inlet temperature. Adjust the balancing valve in the bypass discharge by slowly closing it until the inlet temperature achieves 140˚F.
7. If the temperature to the heater exceeds 140˚F slowly close the valve in the bypass until 140˚F is maintained.
8. Operate the pool heater until the desired water temperature in the pool is achieved. Observe all components for proper operation.

*** DO NOT CHANGE THIS SETTING**

## SPA AND HOT TUB SAFETY

The following safety rules must be observed while operating a spa or hot tub.

1. Spa or hot tub water temperatures should never exceed 104ºF (40ºC). A temperature of 100ºF (38ºC) is considered safe for a healthy adult. Special caution is suggested for young children.
2. Drinking of alcoholic beverages before or during spa or hot tub use can cause drowsiness which could lead to unconsciousness and subsequently result in drowning.
3. Pregnant women beware! Soaking in water above 102˚F (39˚C) can cause fetal damage during the first three months of pregnancy (resulting in birth of brain-damaged or deformed child). Pregnant women should observe the 100˚ F (38˚C) maximum rule.
4. Before entering the spa or hot tub, users should check the

water temperature with an accurate thermometer; spa or hot tub thermostats may err in regulating water temperatures by as much as 4˚F (2˚C).
5. Persons with medical history of heart disease, circulatory problems, diabetes or blood pressure problems should obtain their physician's advice before using spas or hot tubs.
6. Persons taking medications which induce drowsiness, such as tranquilizers, antihistamines or anticoagulants, should not use spas or hot tubs.

## HEAT EXCHANGER INSPECTION

***TUBES***

This pool heater is designed to operate without the accumulation of scale in the heat exchanger, even in very hard water. Periodic inspection of the tubes should be made to be sure that no scale is accumulating when operating the pool heater in hard water areas or when pool chemistry has not been properly maintained. Removable threaded inspection plugs are provided on the front header of the heat exchanger. If there is any doubt about proper water flow, water hardness or maintenance of proper water chemistry, the plugs should be removed at the end of the first 30 days of operation and the tubes inspected for scale accumulation. This inspection should be repeated again at the end of 90 days of operation and then at the end of each six months of operation thereafter.

A scale deposit of paper thickness is normal. Heavier deposits should be cleaned out with a brush or reamer. If scale deposits are found in the tubes, **THE CAUSE MUST BE FOUND AND CORRECTED.** Inspect the tubes on a regular interval to ensure that the cause for the scaling has been corrected.

The probable cause for scaling is improper water chemistry. Check the following possible causes:
1. High pH
2. Improper adjustment of the heater bypass valves.
3. Inadequate pump flow.
   Always be sure the pool heater bypass pump is in good operating condition and runs continuously when the pool heater is in operation.

***PREVENTION OF FREEZING***

Heat exchangers, headers, pumps or bypass assemblies damaged by freezing are **not** covered by warranty. If the pool heating equipment is subject to freezing temperatures, the following precautions must be observed:

***WINTERIZING***

1. Shut off the gas supply.
2. Shut off the water supply.
3. Shut off the electrical supply to both the pool heater and the bypass pump.
4. Drain the heat exchanger and bypass assembly completely by removing threaded inspection plugs from both the inlet and outlet side of the front header. Use an air hose to blow any remaining water from the heat exchanger tubes.
5. Drain the pump and related piping.

## AUTOMATIC CHLORINATORS AND CHEMICAL FEEDERS

All chemicals must be diluted into the pool or spa water being circulated through the pool heater. Any concentration of chlorine in the pool heater can cause damage to the unit. **DO NOT** place chlorine tablets or bromine sticks in the skimmer. High chemical concentrations will result when the pump is not running.

Chlorinators **MUST** feed downstream of the heater and have an anti-siphoning device to prevent chemical back-up in the heater when the pump is shut off.

**IMPORTANT:** High chemical concentrations from improperly adjusted feeders and chlorinators can cause rapid corrosion to the heat exchanger. This damage is non-warrantable.

## WATER PRESSURE SWITCH

The pressure switch is factory preset for normal installations at deck level. The adjustment knob is set at 5 psi. The switch will stop operation of the pool heater on low water flow. **DO NOT** adjust the pressure switch unless the pool heater is located more than 4 ft. above or below the deck level.

## PRESSURE SWITCH ADJUSTMENT

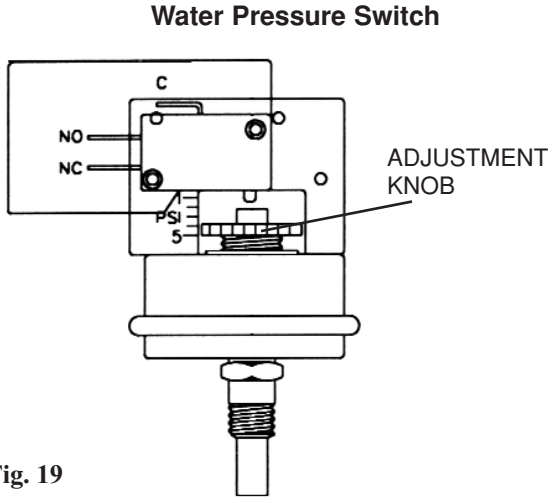


**Fig. 19**

The adjustment knob will increase the switch pressure setting when turned clockwise and decrease the pressure setting when turned counter-clockwise. Check operation of the pressure switch whenever an adjustment is made to the setting on the switch. To check operation, turn on the heater and pump. Turn the pump off and on several times to ensure proper operation of the water pressure switch on low or no water flow to the pool heater.

## FACTS ABOUT WATER CHEMISTRY

Factors which affect pool and spa water and, more importantly, the efficiency of your new pool/spa heater are:

1. PROPER FILTRATION
2. PROPER CIRCULATION
3. DISINFECTION AND OXIDATION
4. pH CONTROL AND TOTAL ALKALINITY
5. ALGAE CONTROL

The water chemistry of your pool or spa changes daily due to natural evaporation of the water and the addition of chemicals. Chemicals are used to sanitize and control algae growth in the pool. Their addition must be carefully monitored. If there is an imbalance in the pool water chemistry, the minerals in the pool water will precipitate out and collect in the pool, filter system and the pool heater. The accumulation of minerals or scale in the pool heater due to a chemical imbalance will cause a non-warrantable failure of the heat exchanger and its components.

pH is the most important factor in maintaining proper balance in your pool/spa water. pH is the measurement of the acidity or alkalinity of water. The chart below shows the ideal pH range and what can happen when the pH increases or decreases from the ideal of 7.2 to 7.8.

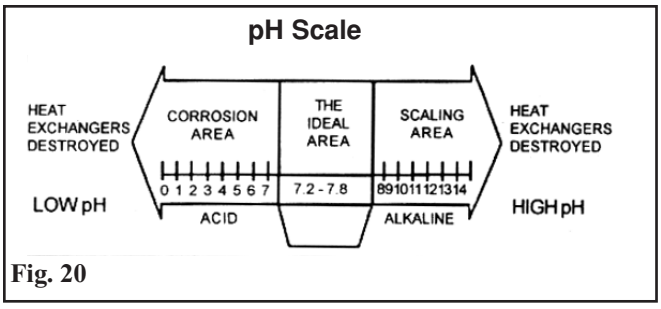


**Fig. 20**

If the pH becomes too high, it lowers the ability of chlorine to destroy bacteria and algae, water can become cloudy, filter elements may become blocked, and scale formation will occur in the pool and heat exchanger. If the pH becomes too low the water becomes acid. You can have eye burn and skin irritation, etching of the plaster, corrosion of metal fixtures and the resulting stains on the plaster, degradation of sand and gravel filters and corrosion of the copper tubes in the heat exchanger.

**Damage to the pool heater due to improper pH is non-warrantable.**

We recommend using a four-way test kit to monitor the Following levels to ensure proper operation of your pool heater:

| Recommended Water Chemistry | |
|---|---|
| **Test** | **Recommended Level** |
| Correct pH | 7.2 - 7.8 |
| Chlorine Residual | 1.0 - 5.0 PPM |
| Total Alkalinity | 80 - 120 PPM |
| Calcium Hardness | 175 - 350 PPM |

**Fig. 21**

Chlorine residual is the chlorine remaining in the pool water after it is consumed in the process of destroying bacteria, algae and other oxidizable materials. Total alkalinity is the measurement of the total amount of alkaline chemicals in the water. Alkalinity controls pH. Sodium bicarbonate is used to raise total alkalinity. Calcium hardness can be raised by the addition of calcium chloride, and lowered by the addition of Tri-sodium Phosphate or its equivalent.

The corrosive level of pool water can also be measured by the Langlier Saturation Index. This index is calculated by a formula which uses operating temperatures, total alkalinity, pH, calcium hardness and total dissolved solids. The optimum Saturation Index value is zero. A negative value indicates a corrosive condition. Your pool/spa dealer can provide additional data and equipment to make this measurement if a problem exists.

## ENERGY SAVING RECOMMENDATIONS

1. Keep the pool/spa covered when not in use. This will cut heating cost, reduce water evaporation, conserve chemicals and reduce load on the filtering system.

2. Reduce pool thermostat to 78˚F or lower, reduce spa temperature to 100˚F.

3. Use an accurate pool/spa thermometer to monitor water temperature.

4. Mark the proper temperature settings on your pool/spa thermostats and discourage further adjustments.

5. Use a time clock to start filter pump no earlier than 6 a.m. during pool/spa season. This is the time when nightly heat loss stabilizes.

6. Turn the pool/spa heater off and drain during long periods when the pool will not be used (winter, vacations, etc).

7. Follow a regular program of preventative maintenance for your heater each new swimming season. Check heat exchanger, controls, burners and operation of the unit.

8. For pools used only on weekends, the thermostat may be set lower than 78ºF during the week. Lower setting to a range that can be easily achieved in one day's operation of the pool heater.

## COMMERCIAL POOL HEATER PIPING DETAIL
## SINGLE HEATER INSTALLATIONS

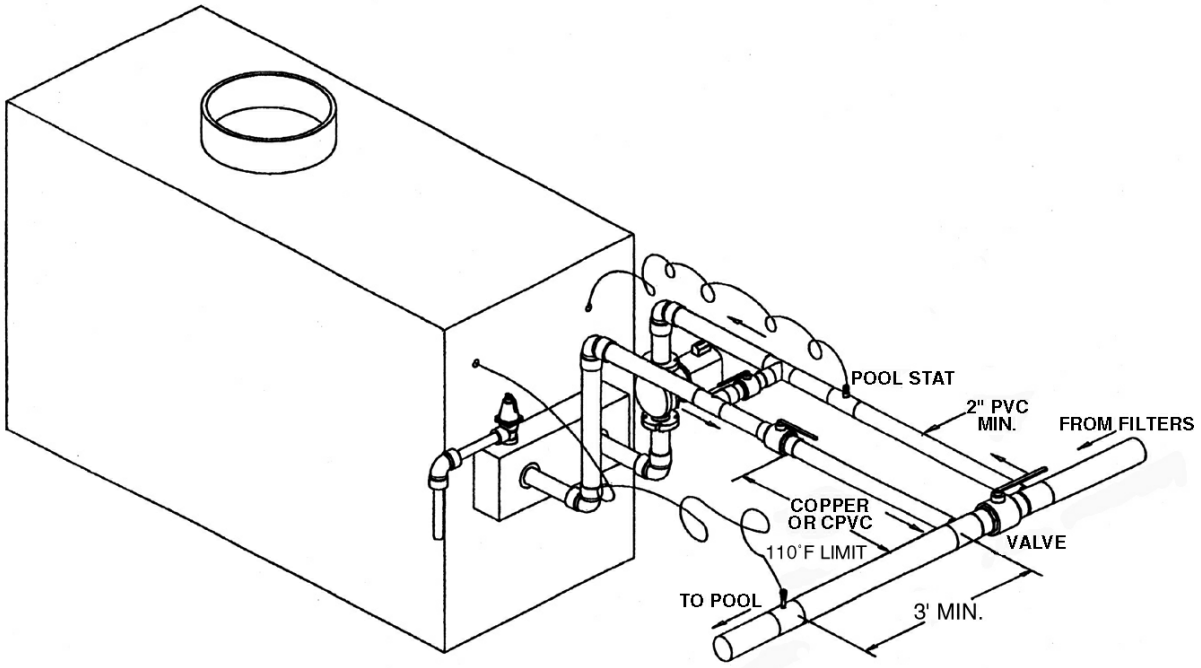


**Fig. 22**

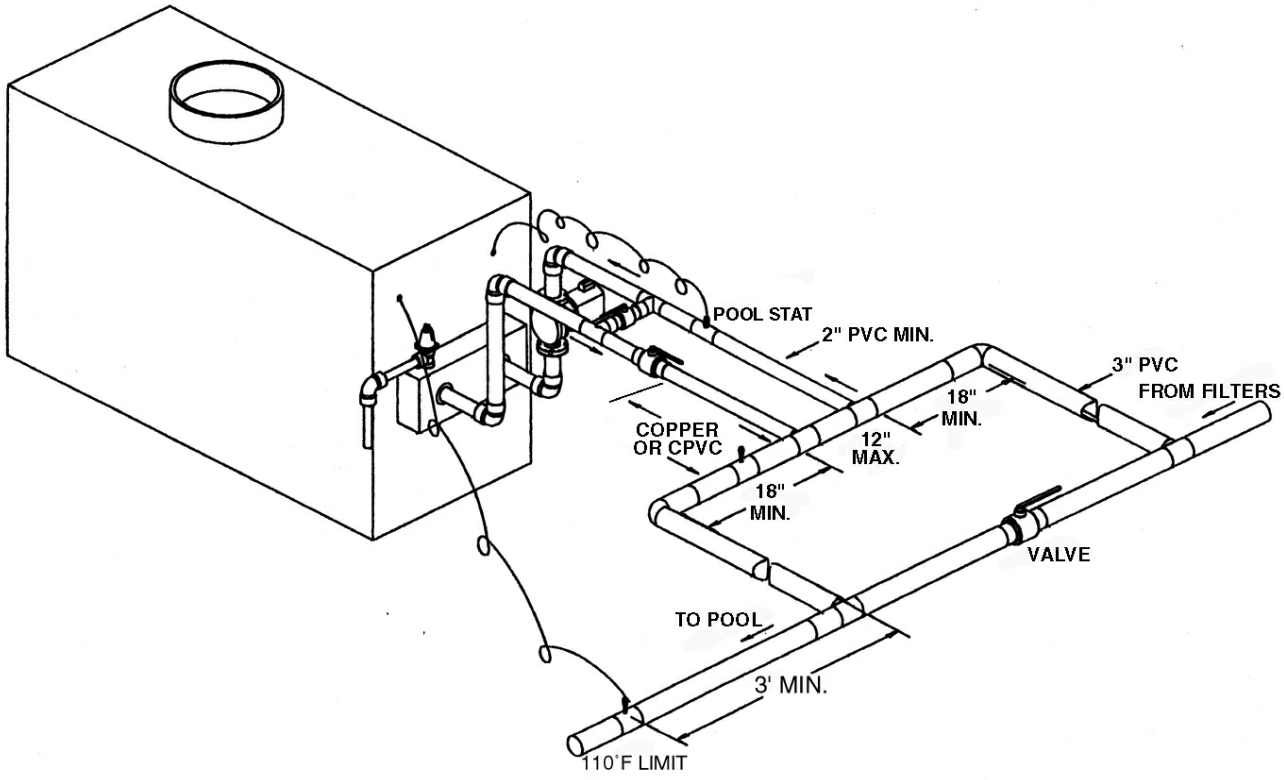


**Fig. 23**

## COMMERCIAL POOL HEATER PIPING DETAIL
## MULTIPLE HEATER INSTALLATIONS

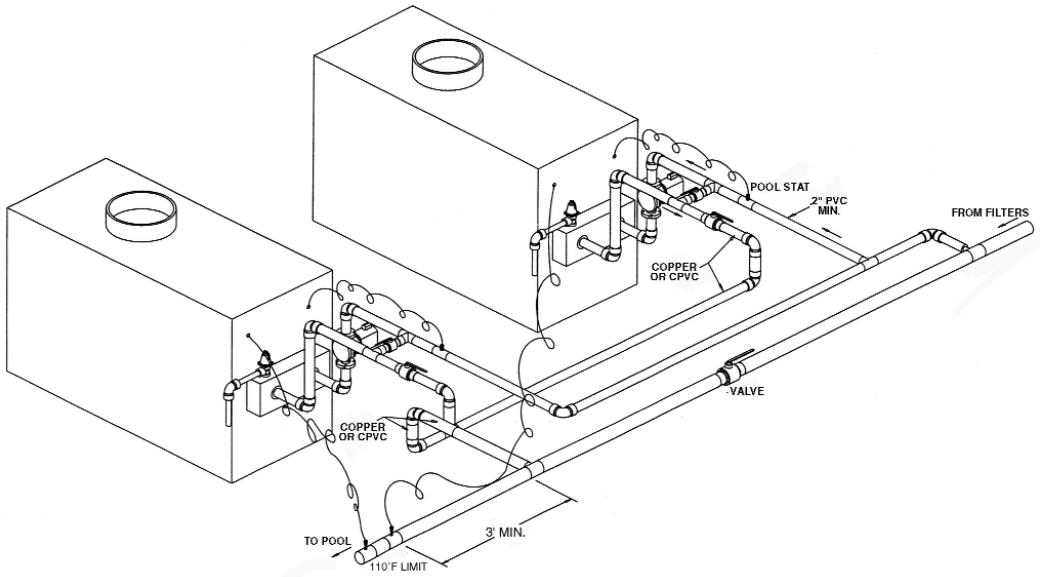


**Fig. 24**

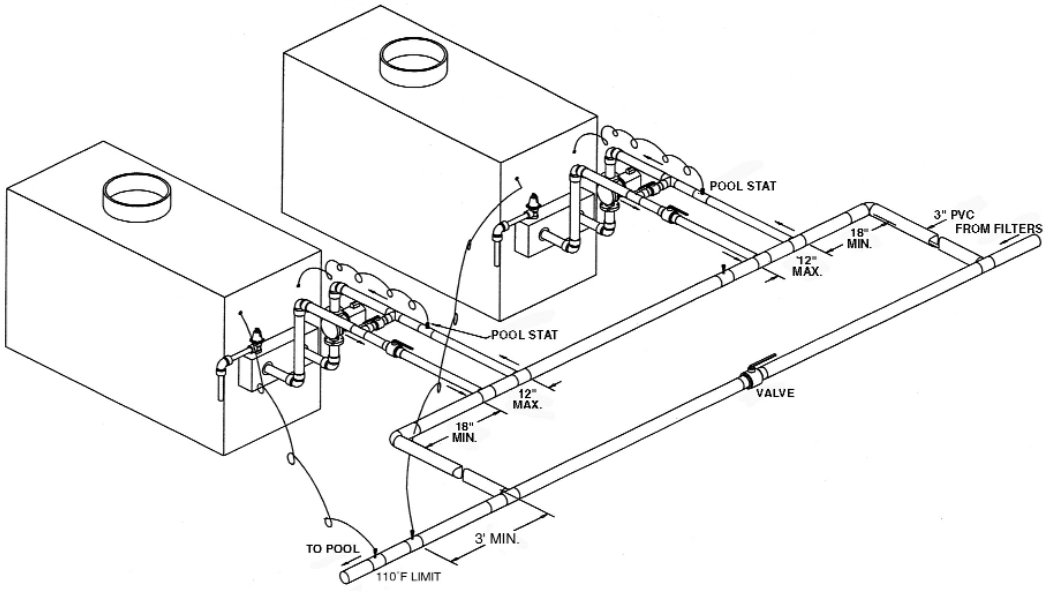


**Fig. 25**

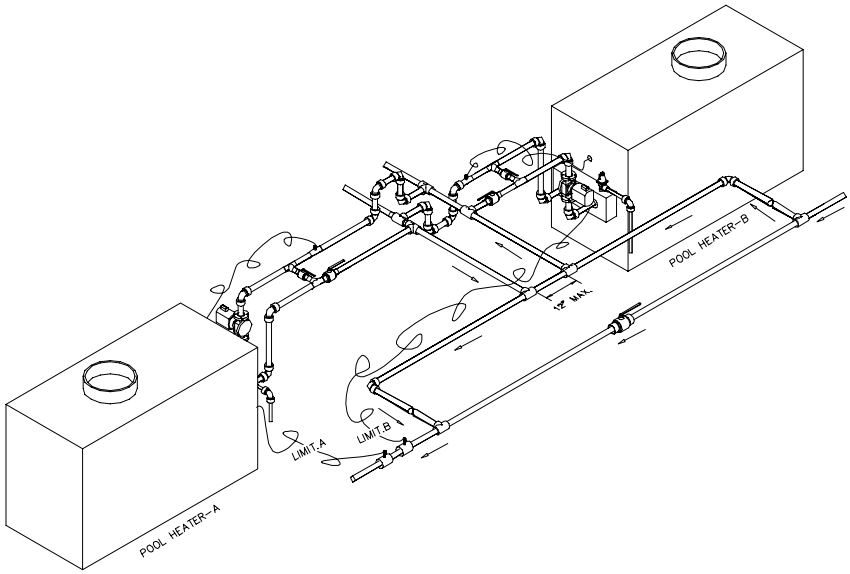


**Fig. 26**





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